A Comprehensive Study on Exploring the Potential Challenges of Chatbot Research as Future Directions for Advancing Knowledge in Artificial Intelligence Conversation System

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Abstract - Chatbots are a part of artificial intelligence (AI) computer software which can attempt to communicate through text or voice technology. The idea behind Conversation is artificial intelligence that analyzes customer data and responds to it. Contacting customers doing the live chat has become a way to provide true customer services are in many retail environments. Today, human communication tools are often replaced by chat or chat software; this is often an artificial intelligence (AI)-based machine designed to communicate with humans through natural language.. (Adam M et al.). To contribute to the knowledge of this new research area, we present the research in the form of future directions and problems that will be addressed through research interviews. A computer architecture specifically to reoccur a talk with a human user on the global Internet. Social factors and relationships: Chatbots facilitate change and increase social awareness.

***Key Words*:** artificial intelligence, chatbots, natural language processing, robots

1.INTRODUCTION

A chatbot (interactive**,** intelligent agent) is a computer t hat understands human speech and communicates wi th users via the web or text messages**.** Chatbots can perf orm many online tasks**,** from answering simple quest ions and scheduling calls to writing customer

recommendations. Companies use bots to streamline bu siness processes, improve customer experience and re duce support costs.(Rohit Tamrakar et al. 2021) The real-time nature of chat services has transformed customer service into a two-way communication with significant effects on trust, satisfaction, and repurchase as well as WOM intentions (Mero 2018). Over the last decade, chat services have become the preferred option to obtain customer support (Charlton 2013). More recently, and fueled by technological advances in artificial intelligence (AI), human chat service agents are frequently replaced by conversational software agents (CAs) such as chatbots, which are systems such as chatbots designed to communicate with human users by means of natural language (e.g., Gnewuch et al. 2017; Pavlikova et al. 2003; Pfeuffer et al. 2019a).(Adam M et. al.)

2. More about chatbots

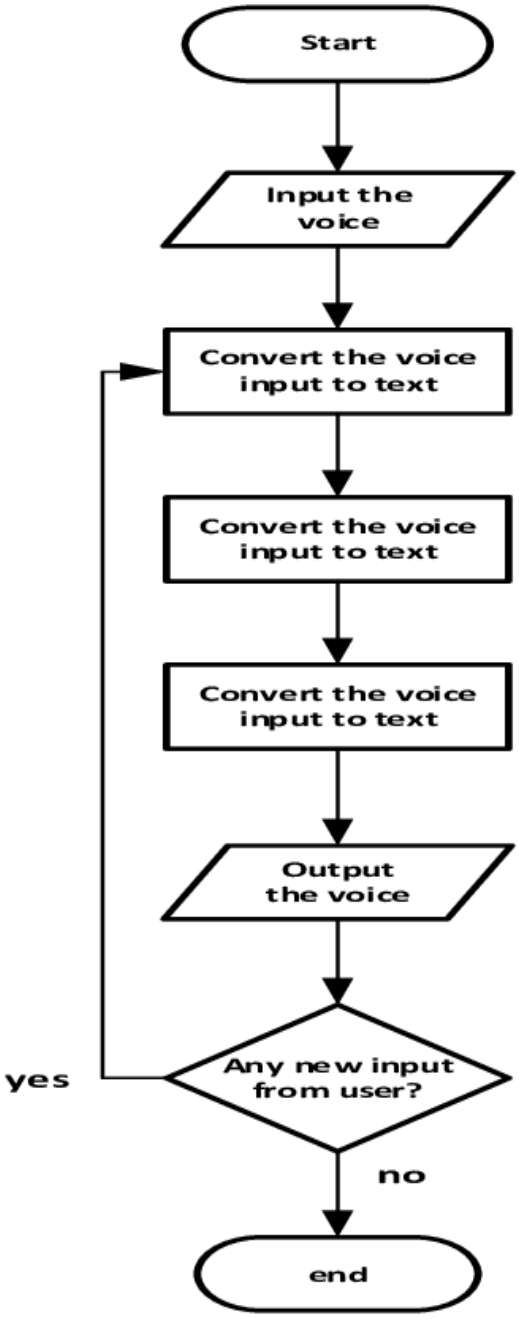

Fig1. Flowchart of the Working of Chatbots, Source: (made by the author)

1 Classification of Chatbots

Chatbots can be categorized into various classifications build on their capabilities and also including functions. Rules-based chatbots follow defined rules and are suitable for simple tasks; AI-powered chatbots, on the other hand, use Artificial intelligence or expert systems and machine learning, including natural language processing (NLP), for a difficult conversation.

1.1 Rule-based Chatbots.

Policybased chatbots provide branch questions that website visitors can choose from. Policy bots are also procedural bots that provide procedural-like questions. Site visitors can click on questions and get answers. At best, proper chatbots have no artificial intelligence behind them. You can build a bot without any technical skills, which is a code-based chat. (Vajinepalli Sai Harsha Vardhan et al. 2022)

• Online enterprise proprietors can create a communique script and install it in a guideline-based chatbot.

• Rule-based chatbots cannot answer complex questions. If the client asks questions that aren't in the script, a fully rules-based chatbot will struggle to answer.

• Rule-based full chatbots don't understand internet site visitors if they ask complex questions.

1.2 Conversational AI Chatbots

Conversational AI successfully replicates human communication. An AI bot will talk to customers by linking one query to all the others. (Aafiya Shaikh et al. 2019)
The synthetic intelligence and device getting to know technologies in the back of an AI chatbot will anticipate customer questions and provide the right answers.

• The conversational AI bot is aware of grammatical errors and automatically corrects them.
• The bot's AI can easily recognize a person's purpose and purchase intent.
• The AI chatbot converses like a real character. Website traffic will experience as if they could be conversing with human marketers while talking to an AI chatbot. online chat AI copies human conversation.(D. Chousiadas at al. 2020)

2 Different Models of Chatbots

Chatbots can be categorized into different models, including rule-based chatbots that follow predetermined rules, retrieval-based chatbots that select reactions from a predefined database, and generative chatbots that create responses from scratch using natural language generation. Rule-based chatbots are suitable for simple tasks, while retrieval-based models are often used for customer support, and generative chatbots excel in generating diverse and contextually relevant responses.

Table 1. Description

Source: (made by the author)

Models of Chatbots	Description
Menu/Button-Based Chatbot:	Menu/button-based Chabot are the most basic form of Chabot currently carried out within the marketplace. In most cases, those Chabot are glorified selection tree hierarchies presented to the person in the form of buttons.
Linguistic Chatbot:	If you could anticipate what questions your customers might additionally ask, a language Chabot might be the answer for you. Linguistic or instruction-based Chabot create conversational automation flows using common sense.
Keyword recognition-based Chabot:	Unlike menu-based Chabot, keyword popularity-based full chatbots can listen to the types of opinions users give and respond appropriately. These chatbots use customizable key phrases and an AI utility called Natural Language Processing (NLP) to determine the best way to respond to a person.
Machine- Learning Chabot	Ever confused what a contextual chatbot is? Contextual chatbots are way more advanced than the three bots mentioned earlier. These types of chatbots use system mastering (ML) and synthetic intelligence (AI) to recall conversations with specific customers to investigate and develop over the years. (Yann LeCun et al. 2020)

3 Comparison of different models of chatbots

Comparing different chatbot models, rule-based chatbots rely on predefined rules and are suitable for basic, structured tasks and FAQs. Retrieval-based chatbots select responses from predefined databases based on input similarity, making them effective for customer support and information retrieval.

Table 2. Advantages and disadvantages of Menu button based, Linguistic based, Keyword recognition and Machine learning chatbots

Source: (made by the author)

TYPES OF CHATBOTS	ADVANTAGES	DISADVANTAGES
Menu-button based Chatbot	User-friendly interface	Limited flexibility
	Simplified interaction	Limited personalization
Linguistic based Chatbot	Flexible and dynamic interactions	Complex development
	Improved user experience	Training requirements
Keyword recognition Chatbot	Simplicity of implementation	Limited flexibility
	Quick and direct responses	Inability to manage queries
Machine learning Chatbot	Improved understanding	Data dependency
	Adaptive and self-learning	Limited control and transparency

4 Applications of Chatbots

Chatbots find application across diverse industries, with customer support being a primary use case. They provide instant assistance, answer FAQs, and resolve issues swiftly. In e-commerce, chatbots aid users in product search, recommendations, and payment processing, enhancing the online shopping experience.

4,1 Customer Support and Service:

Chatbots are regularly used to offer on the spot customer service and answer regularly requested questions on websites and in mobile apps**.** They can manage customer inquiries, resolve issues, and escalate to human agents when necessary.

4.2 E-commerce and Shopping:

Chatbots assist users in finding products, making purchase recommendations, and facilitating online shopping. They can also manage order tracking and provide information on promotions and discounts**.**

4.3 Healthcare and Medical Advice:

Chatbots in healthcare help users find healthcare providers, schedule appointments, and provide general medical advice for common symptoms. Some can even monitor patient health data and offer medication reminders.

4.4 Virtual Assistants:

Digital assistants like Siri, Google Assistant, and Alexa are chatbots that carry out duties inclusive of setting reminders, answering questions, controlling clever domestic devices, and providing weather updates.

4.5 Finance and Banking:

Chatbots help users with banking inquiries, checking account balances, transferring funds, and even providing financial advice. They can also assist in detecting and reporting fraudulent transactions.

4.6 Travel and Booking:

Journey chatbots assist users in booking flights, resorts, and condo automobiles. They can also provide travel guidelines, weather updates, and records approximately nearby attractions.

4.7 Education and E-Learning:

Educational chatbots help students with homework, provide explanations on diverse topics, and offer interactive learning experiences. They can be used in online courses and tutoring.

4.8 Human Resources and Employee Support:

HR chatbots handle employee inquiries related to benefits, leave requests, company policies, and onboarding processes. They streamline HR tasks and improve employee engagement.

4.9 Content Delivery and News Updates:

Chatbots can supply personalized content material, information updates, and suggestions based on user possibilities. They hold users knowledgeable and engaged.

5 Algorithms of AI chatbots

AI chatbots use various algorithms and techniques to perform tasks such as understanding user inputs, generating responses, and improving their interactions.

5.1 Naïve Bayes Algorithm

The e Bayes set of rules attempts to categorize text into various corporations in order that the chatbot can decide the user's reason, for this reason decreasing the range of responses. it's miles vital that this algorithm capabilities properly because cause identificat ion is the first and one of the most important stages in chatbot discussions .Tool used under Naïve Bayes Algorithm- Scikit-Learn.

5.2 Support Vector machine

The Structural hazard Minimization principle serves as the inspiration for how SVMs function. due to the high dimensional input space created through the abundance of textual content functions, linearly separable statistics, and the prominence of sparse matrices, SVMs carry out particularly properly with textual content statistics and Chatbots. Tool used under Support Vector Machine- LibSVM.(K. Rarhi et al. 2018)

5.3 Natural language processing (NLP)

For chatbots, NLP is particularly important because it controls how a bot recognizes and interprets text input. the right chatbot can talk to the user in a way that they don't even realize they're talking to a machine.Tool used under Natural Language Processing-NLTK (Natural Language Toolkit).(Vitória Helena Pavanato et al. 2017)

5.4 Recurrent neural networks (RNN)

Recurrent Neural Networks are the type of Neural networks that allow sequential facts to capture context of the words in every input of text.
RNN tactics the text input just the way biological intelligenc e strategies the records, it techniques sequences by using iterating thru the sequence elements and preserving a c ountry containing facts relative to what it has visible thus far. as a result, permitting us to interpret and seize the

context of the enter. Tool used under Recurrent neural networks-TensorFlow.

5.5 Markov models for text generation

Markov chains are frequently used in chatbots and text manufacturing. They function by way of calculating the probability of moving from one kingdom to any other. So, it can be conveniently stored as matrices, this model is straightforward to use and summarize. These chains rely on the previous nation to identify an existing kingdom, rather than consider the path to get there. Tool used under Markov models for text generation- Markovify.

6 Chatbot Market Size and Accuracy Comparison Diagram

The term "chatbot market size" refers to the estimated value or revenue generated by the chatbot industry within a specific time frame, typically expressed in monetary terms (e.g., in billions of dollars). It represents the total market value of products, services, and solutions related to chatbots, including the development, deployment, and use of chatbot technology and applications.

An "Accuracy Comparison Diagram" is a visual representation that allows for the comparison of different chatbot programs or models based on their performance in various test scenarios. It typically features a title indicating its purpose, with chatbot programs listed on the x-axis and an accuracy metric, often represented as a percentage, on the y-axis. Data points or markers for each program indicate their respective accuracy scores, often connected by lines or bars to visualize trends. A legend explains data point meanings, color coding helps distinguish programs, and annotations provide context. These diagrams are valuable for assessing and selecting the most suitable chatbot program based on performance, aiding researchers, developers, and decision-makers in making informed choices for specific use cases.

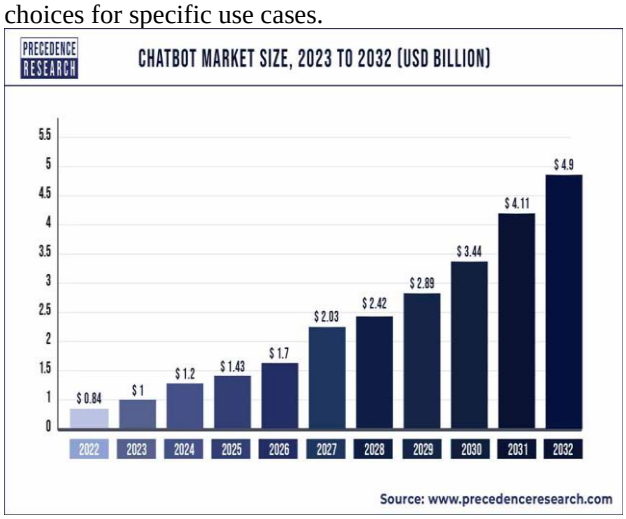

Fig.2 Chatbot Market Size

Source: (precedenceresearch 2022)

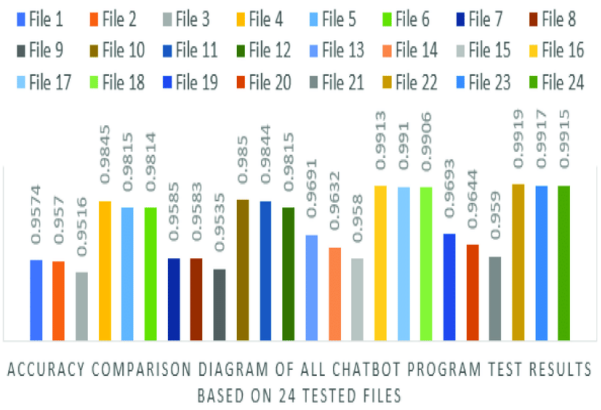

Fig.3 Accuracy Companion Diagram of all chatbot program test results
Source: (Dipti More 2018)

7 Future directions in Chatbots

While chatbot research has an incredibly expansive frame of understanding, rooted in long-standing study areas, modern research and understanding is fragmented across disciplines, application areas, and groups. Such fragmentation is to be expected in a rapidly expanding subject. (S. P. Erdeniz et al. 2018) But, we are now at a time where miles are useful for general instruction in the study of fate. (Dong-Min Park et al. 2022) Identifying unusual research instructions is not always something that can be done by individual researchers or single communities. Alternatively, it should be seen as a collaborative and ever-evolving process across people and communities, where improvements are made entirely based on new insights and information as it is so cumulative. (ok. Cho et al. 2014)

Our aim to provide these paintings is to provide a desired interdisciplinary and collaborative basis to initiate and guide broad dialogue on key destiny study directions for chatbot study.

As such, the illustrations will provide a broader angle on research directions than what has been provided, for example, current critiques on chatbots in specific domains, unique aspects of chatbot era and layout, or consumer behavior and enjoyment.

Moreover, we encounter views and topics for chatbot studies that may be more widely spread than can be determined within, for example, the fields and disciplines in which chatbot research has its roots. As such, we intend to deliver a basis for a bot study for paintings that fees alike to analyze and practice, and that can also serve to bridge related research currently embedded in wonderful disciplines. (M. Vasileiou et al. 2020)

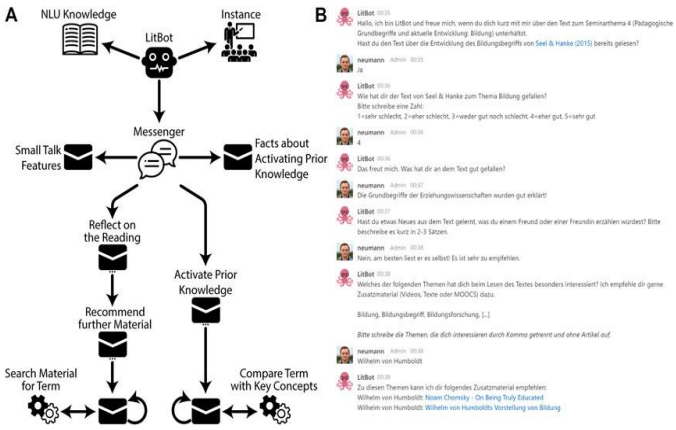

Fig.4. Chatbot having conversation with a human online , Source: (made by the author)

3. CONCLUSIONS

A chatbot is an computer application that simulates a person's interaction, using artificial intelligence (AI) and na tural language processing (NLP) to understand and respond t o customer questions**.**(Vajinepalli Sai Harsha Vardhan et al. 2021) A chatbot is one of the easy approaches to transport records from a computer while not having to assume for proper keywords to look up in a search or browse several internet pages to collect records; customers can easily type their question in natural language and retrieve facts.(D. Bahdanau et al. 2015) instant reaction – Chatbots can manage the queries of thousands of clients right away in addition to simultaneously and enhance the common reaction time. Consistency in solutions – using chatbots can assist agencies maintain a super degree of consistency in answers and enhance client enjoy with the logo.

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